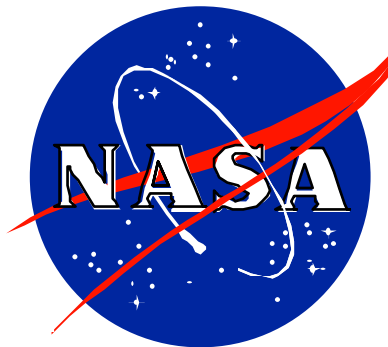


Neutral Buoyancy Laboratory External Users Guide

EVA, Robotics, & Crew Systems
Operations Division
Neutral Buoyancy Office

October 2001

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National Aeronautics and
Space Administration

Lyndon B. Johnson Space Center
Houston, Texas


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Neutral Buoyancy Laboratory External Users Guide

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Change Record			
Rev.	Date	Originator	Description
Basic	10/2001	E. Becker	(CN #01-0010-01) Initial release of document to replace “SHI-NBL-W0013 NBL External Users Guide”.

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ACRONYMS

AR	Action Request
CA	Customer Agreement
CSP	Customer Supplied Product
EAP	Emergency Action Plan
EMI	Electromagnetic Interference
EVA	Extravehicular Activity
FM	Facility Manager
FUR	Facility Utilization Request
IET	Integration Engineering Team
JSC	Johnson Space Center
LMF	Light Manufacturing Facility
LOX	Liquid Oxygen
MAA	Multi Altitude Article
MSDS	Material Safety Data Sheet
NASA	National Aeronautics Space Association
NBL	Neutral Buoyancy Laboratory
NBL OCC	NBL Operations Control Center
OPS	Operations
PC	Property Custodian
PPE	Personal Protective Equipment
RFI	Radio Frequency Interference
SCTF	Sonny Carter Training Facility
SDIL	Software Development and Integration Lab
SM&O	Sustaining Maintenance & Operations
SRMS	Shuttle Remote Manipulator System
SSRMS	Space Station Remote Manipulator System
TC	Test Conductor
TD	Test Director
TRR	Test Readiness Review
TS	Test Sponsor
TSE	Training Session Evaluation

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1 **SAFETY**

1.1 **GENERAL SAFETY POLICY**

All personnel are responsible for their safety and the safety of their coworkers. The following specific requirements apply to all facility users.

All visiting personnel requiring access to the NBL to conduct work in the NBL will be required to attend a facility orientation, including viewing the NBL safety video upon their initial visit to the facility, and again if it has been more than six (6) months since their last visit.

If you observe conditions that jeopardize the safety of personnel, equipment or the facility, take immediate action to stop the work or event in progress. Report the safety problem to the Neutral Buoyancy Laboratory Operations Control Center (NBL OCC) so that proper follow up action can be initiated. When in doubt, report it.

Any activities involving the overhead crane must adhere to current Johnson Space Center (JSC) regulations and Critical Lift Criteria.

You are not allowed to operate any NBL equipment without the proper JSC/NBL certification. (See Sections 6 and 7, *User Responsibilities* and *Personnel Requirements*.)

Various work activities occur throughout the NBL that have restrictions and require you to take specific safety precautions. These include but are not limited to overhead crane operations, welding, cutting and grinding, electrical work, high-pressure gas operations, chemical handling, and Liquid Oxygen (LOX) operations. Failure to obey posted safety operations can result in personal injury and death. Personnel observed violating safety requirements will be disciplined.

1.2 **PERSONAL PROTECTION EQUIPMENT (PPE)**

All personnel inside the NBL are personally responsible for properly wearing the appropriate PPE required for the task they are performing or required by the area in which they are working.

1.2.1 **Safety Glasses**

Visitor safety glasses are available at numerous locations throughout the NBL. It is strongly recommended that users provide their own safety glasses if working within the NBL for more than a day. Tinted glasses will not be worn inside the NBL.

1.2.2 **Hard Hats**

Due to personal hygiene requirements, hard hats will not be provided by the NBL. Users must supply their own hard hats for use when working with the cranes or in and around overhead-suspended loads.

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1.2.3 Steel-Toed Shoes

Users must supply their own foot protection for use when working around and/or with, moving, or transporting heavy equipment. In addition, users shall ensure they utilize their safety shoes whenever they are inside the designated lift zone. Foot protection must meet OSHA requirements.

1.2.4 Safety Harnesses

Safety harnesses will not be provided by the NBL. Users must supply their own safety harnesses for use when working aloft. OSHA standards apply for determination of requirements for conditions when safety harnesses are required.

1.2.5 Other Safety Equipment

It is the responsibility of the user to provide all other safety equipment required for the performance of work to be done at the NBL. This includes, but is not limited to: welding arc shields, chemical handling garments and face shields, gloves, respirators, and dust masks, etc.

1.3 EMERGENCY PROCEDURES

The Sonny Carter Training Facility (SCTF) Emergency Action Plan (EAP) is located at the front of the NBL by the NBL OCC Station. Copies are available from the NBL OCC. The EAP covers all actions required of personnel working within the NBL in case of an emergency. Please become familiar with this document. Specific critical actions are identified below.

In the event of any emergency such as a fire, gas leak, chemical spill, LOX leak, personnel injury emergency (other than minor), etc., immediately sound the alarm and call the following to report the emergency:

NASA/JSC FIRE & SAFETY DISPATCH CENTER at 3-3333

After completing the call to the ANSA/JSC FIRE & SAFETY DISPATCH CENTER, contact the NBL OCC if you are not placing yourself in danger.

If you hear an alarm or you are told to evacuate, proceed to the nearest building exit. Once you have exited the building, proceed to the South side of the NBL to the assembly area as shown in the EAP available from the NBL OCC Station. Follow directions of NBL personnel in charge of the assembly area.

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2 GENERAL OPERATIONS

2.1 GENERAL CLEANLINESS POLICY

KEEPING IT CLEAN IS EVERYONE'S RESPONSIBILITY

Debris, inadequate cleanliness, and disorder are major causes of accidents. No safety program can work without good housekeeping. Everyone using the NBL/SCTF is expected to police his or her work area.

If you have any questions or concerns regarding the cleanliness of the NBL, please contact the NBL OCC for assistance.

The following guidelines are to be used to maintain the minimum acceptable cleanliness standards when working within the NBL.

2.2 WORK IN PROGRESS REQUIREMENTS

If any of the following items are identified or occur, they shall be resolved immediately before any work continues:

2.2.1 Sharp Edges

Objects, protrusions, snags, or corners shall be dulled and/or protected from contact with personnel or equipment.

2.2.2 Spilled Liquids (Non-Hazardous Only)

Spilled liquids shall be cleaned up immediately to prevent the spill from becoming a slip hazard or contaminating or damaging items that may come in contact with it.

2.2.3 Fine Dust

Dust created as a result of work shall be contained so as to prevent tracking by personnel or vehicles, or disturbed due to wind or strong air currents.

2.2.4 Flammable or Toxic Substances

Any flammable or toxic substance that is not stored in an appropriate container and properly labeled shall be immediately removed from the NBL or placed in the appropriate container. All chemicals brought into the NBL must be approved by the Facility Manager (FM) and must come with a Material Safety Data Sheet (MSDS).

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2.2.5 Electrical Safety Hazards

Any electrical device that is not properly grounded or electrically isolated shall be immediately unplugged and removed from service. If appropriate, the item shall be located out and tagged out to prevent inadvertent operation until the problem is resolved. Contact the NBL OCC for “lockout” locks and “do not operate” tags.

The NBL facility contractor operates the NBL lockout/tag out system. All lockout/tag out operations must be cleared through the OCC and recorded in the OCC log. For operation of this system refer to NBL Lockout/Tag Out Procedures (SHI-NBL-W055) available from the OCC.

2.2.6 Biological Waste

If an item is suspected to be contaminated with blood or other biological waste, contact the NBL OCC for assistance in removal and disposal of the material.

2.2.7 Safety Walkways and Access Areas Clear

All safety walkways and safety clearance areas shall remain clear of material and equipment at all times.

2.2.8 Chamber Operations

To prevent lifting operations over the hyperbaric and hypobaric chambers, yellow lights have been installed above each chamber and above the pool deck to warn crane operators of ongoing chamber operations.

2.3 DAILY REQUIREMENTS

At the end of each workday or upon completion of a work task:

- The work area should be swept and cleaned to remove all debris and scrap material.
- Tools should be stored appropriately.
- All raw materials and boxes shall be stored to present a neat and orderly appearance.
- Prior to leaving at the end of the day, contact the NBL OCC. They shall inspect the work area to ensure that all cleanliness requirements are met.

2.4 END OF PROJECT REQUIREMENTS

When all work is completed and prior to leaving the NBL:

- All work areas must be clean.
- All material, equipment, and tools borrowed from the NBL must be returned to the responsible department.
- Contact the NBL OCC. They shall inspect the work area to ensure that all cleanliness requirements are met.

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3 POINTS OF CONTACT

3.1 EMERGENCIES

To report any emergency contact:

NASA JSC FIRE & SAFETY DISPATCH CENTER 3-3333

3.2 GENERAL INFORMATION

All inquiries for facility information, scheduling information, or personnel are to be directed to:

NBL Operations Control Center: (281) 792-5999

3.3 COMMON FACILITY NUMBERS

The following numbers are provided for common areas with the NBL:

Conference Room 2330..... 281-792-5735
 Conference Room 1335..... 281-792-5722
 Test Control (TC) Room A 281-792-5742
 Test Control (TC) Room B 281-792-5725
 Test Director (TD) Room A 281-792-5740
 Test Director (TD) Room B 281-792-5794

4 NBL GENERAL INFORMATION

4.1 HOURS OF OPERATION

Days	Daily OPS Shift	Reconfiguration
Monday - Friday	0730 - 1600	1500 - 2330
Saturday - Sunday	SEE NOTE	As required
Safety/Maintenance Day	Last Friday of every month. No operations or support provided.	
Training/Maintenance Weeks	1 week in both December and June. No operations or support provided.	

NOTE: Weekends may be utilized in the event of critical “real-time” mission support, or special requests through Facility Manager and Operations Manager on a case-by-case basis.

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Prime crew training and real time mission support could preempt any of the above. Facility upgrades may also affect the hierarchy. In case of disputes, the Chief of the Extravehicular Activity (EVA), Robotic and Crew Systems Operations Division shall serve as arbiter. A Facility Utilization Request (FUR) Board (comprised of the Chief, selected personnel, and user representatives) may also be convened to address and resolve FUR issues.

4.2 NBL OPERATIONS CONTROL CENTER (NBL OCC)

The NBL OCC is located in the front-center lobby of the SCTF.

All visitors and external users must check in and out with the NBL OCC whenever entering or leaving the facility. The NBL OCC is the Central Point of Contact for all operations within the NBL. If you need assistance or information, contact the NBL OCC first.

ALL personnel are required to contact the NBL OCC **PRIOR** to performing any work, training, or operations within the NBL.

The NBL OCC Supervisor has the authority when necessary and appropriate to act on behalf of the NBL Manager in order to maintain facility access, security, and operability.

The NBL OCC is also responsible for the safety and accountability of all personnel, visitors, and guests that come to the NBL.

4.3 NBL CONFIGURATION AND CAPABILITIES

The following table provides general information or references to documentation that can provide details concerning the layout capabilities, and limitations of the facility. The latest up-to-date files are readily available. If you need copies of this documentation, need availability information, or have further questions, please contact the NBL OCC.

Subject	Description	Document/POC
Pool	102 (w) x 202 (l) x 40 (d) ft., 85°F ambient	
Overhead Cranes	Load: Rate at 10 tons Coverage: Travel full length of NBL Clearance: 24 ft. over pool deck rail to hook	
Jib Cranes	Load: Rated 3200 lbs. Coverage: Provide utility lifts around perimeter of pool	

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Subject	Description	Document/POC
Laydown Area	Outside storage area used to store mockups, large containers and bulk fabrication materials. Space is limited, so contact the NBL as early as possible to arrange for storage areas.	Contact NBL OCC
High Bay	Provides enclosed work areas for assembly of mockups and test preparation. Work area is limited, so contact the NBL as early as possible to arrange for work areas.	Contact NBL OCC
Electrical Power	115 VAC 60Hz 1Ø, 220 VAC 1Ø, 440 VAC 3Ø	Contact NBL OCC
Flammable Material Storage	The NBL has limited storage facilities for flammable material. Contact the NBL as early as possible to determine if the NBL can support your requirements.	Contact NBL OCC
Chemical and Hazardous Material Storage	The NBL has limited storage facilities for chemicals and hazardous materials. Contact the NBL as early as possible to determine if the NBL can support your requirements.	Contact NBL OCC
Material and Shipping and Receiving	Transfer of all materials into or out of the NBL must be accompanied with the appropriate shipping documentation. The Shipping and Receiving Department is open from 0730 to 1600 daily. Please make arrangements ahead of time for support.	Contact NBL OCC
Facility Layout	A copy of the NBL floor plan is available for specific needs requiring special planning.	Contact NBL OCC

4.4 OFFICIAL VISITORS AND PUBLIC AFFAIRS EVENTS

The NBL has a visitor area open to the public from 8:00 a.m. to 5:00 p.m. Monday through Saturday. All guests are encouraged to use the visitor area with its enclosed viewing area overlooking the pool area.

To schedule non-interference visits and floor access tours, contact the NBL OCC.

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For additional information we invite you to obtain a copy of the “NBL Tour Guide Policy” from the NBL OCC or refer to paragraph 4.8 of the *NBL General Operating Procedures*, DX12-0001.

4.5 NBL SMOKING POLICY

Smoking is not allowed inside the NBL. No smoking is allowed at or near the front entrance to the NBL including at the curb. Designated smoking areas are provided near the back entrance to the Boeing tower, North of the NBL near the pool filters, at the West side of the NBL at the stairway, and behind the LMF.

The use of all smokeless tobacco products (i.e., snuff, chewing tobacco, dipping tobacco, etc.) is prohibited inside the NBL facility. The use of smokeless tobacco products is a sanitation concern and infringes upon the rights of others to work in a clean environment.

5 USER RESPONSIBILITIES

5.1 GENERAL

Facility contractors/residents/occupants, including personnel operating, participating in operations, or utilizing the capabilities of SCTF, including the NBL, the Light Manufacturing Facility (LMF), and the Software Development and Integration Lab (SDIL), are accountable for their actions at this facility.

Facility contractors/residents/occupants, through their FMs or other appropriate entity, will provide coordinated procedures and processes to:

- The SCTF, including the NBL, is a government facility. All visitors are advised that the parking lot in front of the NBL is government property. All the requirements and regulations of JSC, including the prohibition of firearms and weapons, apply to the parking lot and SCTF buildings.
- The only training permitted at the NBL is training that has been properly planned and scheduled. All areas of the pool are not always prepared and safe for training therefore the NBL cannot accommodate requests to train on mockups or in areas of the pool that were not in the days plan for training. Please do not ask for any suited subject training in an area of the pool or on a mockup that has not been part of the training plan and checklist for the day.
- Establish proper control and monitoring of individuals using or visiting the facility, to assure their activities will not adversely impact critical operations across the SCTF and ensure their safety while at the facility.
- Assure facility residents and visiting personnel involved in facility activities establish and maintain a clean, safe, and healthy work area and abide by appropriate rules and regulations for the maintenance of safe operations.
- Allow only the type of work for which a given area in the facility was intended to be used to conduct the work in a safe and efficient manner.

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- Assure activities affecting other SCTF areas/occupants are coordinated across the facility as required.
- Assure non-standard work or deviations from normal operating practices have been reviewed and approved at the appropriate management level.
- Review and control operations configurations, with proper equipment screening and configuration control, so as not to jeopardize operations or allow interference with critical equipment across the SCTF.
- Assure their personnel comply with PPE requirements, and are provided with and properly trained in the use of PPE.
- Assure hazards are marked appropriately, and hazardous areas are identified and established with appropriate entry protection/controls.
- Provide the proper procedures/steps (i.e., SCTF Emergency Action Plan) to be used for emergencies occurring at the facility such that all personnel, even transient visitors, will respond properly.
- Provide for parking of vehicles in appropriate areas that will not create a hazardous situation. Failure to act responsibly in the conduct of activities at the SCTF can result in termination of the activities, disciplinary action, major weakness identification in contractual performance evaluations, or other appropriate corrective action.

To allow the FM to arrange for any special needs and to minimize conflicts for competing resources, 30 days in advance of your initial arrival you must provide the FM the following information:

- Electrical equipment you will provide
- Power requirements
- Rigging/Lifting requirements
- Space requirements
- Personnel you will provide

It is your responsibility to arrange and schedule any support you might need from other organizations (e.g., Safety Division, Quality Assurance and Engineering Division, NASA Riggers, Medical Sciences Division). Such arrangements must be noted on the FUR.

It is your responsibility to arrange for any special tools, training equipment, mockup outfitting, and material you need that the NBL does not provide such as Class I hardware.

If you are having special hardware delivered, notify the NBL OCC, if applicable (see Hardware Delivery/Removal and Customer Supplied Product Handling Procedure), of the arrival time. The NBL will handle the installation, if needed; however, we ask that you or a representative be present during the installation.

The NBL OCC must be notified of all deliveries containing hazardous substances.

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Conduct a pre-test briefing with all participants prior to any hazardous activity or suited exercise. The briefing shall cover the objectives, roles, responsibilities, safety issues, and emergency termination criteria and procedures. A Test Readiness Review (TRR) may also be required.

Most of the equipment at the NBL is Class III (e.g., comm. system, cameras, seats, etc.). Some of the equipment, such as the airlock hatches, was originally designed for operation in zero gravity/Neutrally Buoyant condition only. **Do not** operate equipment without proper NBL certification/qualifications or assistance. Ask for assistance if there is any doubt.

If you need to remove or install mockups or mockup hardware, you will be required to coordinate it with the Integration Engineering Team (IET) group and the Operations Configuration Supervisor.

Once a mockup has completed TRR, all changes, modifications, or additions to a test configuration must be approved by the IET. The purpose of this requirement is to prevent changes from occurring to a configuration that may impact the stability, weight handling requirements, or safety of the divers and/or test subjects.

Users of the Test Conductor (TC) area are responsible for its cleanliness after each test.

Please be punctual and adhere to your allotted time.

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6 PERSONNEL REQUIREMENTS

In order to gain access and to work inside the NBL, specific documentation and/or training requirements must be completed.

It is the user's responsibility to ensure that all requirements are met in a timely manner to support needs. The following tables are provided as a guide to assist you in determining which requirements need to be completed. If you have any questions, please contact the NBL OCC.

6.1 SKILL MATRIX

SKILL/REQUIREMENTS Matrix									
Requirement Skill	NASA Badge	NBL Badge	Orientation/Video Training	Class III Physical	Authorization to Dive	Duty Station Training	Crane Operator Card	Shop Equipment Safety	Security Paperwork
NBL Access	X	X	X						
Diver (Scuba)	X	X	X	X	X	X			
Suited Subject	X	X	X	X	X	X			
Test Conductor	X	X	X			X			
Technician	X	X	X					X	
Facility Maintenance	X	X	X						
Material Handling Equipment Operator	X	X	X				X		
Foreign National	X	X	X						X
Physiological Training	X	X							

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6.2 REQUIREMENT SOURCE MATRIX

REQUIREMENT SOURCE MATRIX		
Requirement	Item to be Completed	Contact
NASA Badge	NASA Form 1470	NASA Security
NBL Badge	Email or Memo to NBL Facility Manager or NBL Office Chief	NBL OCC
Orientation/Video Training	Facility Safety Orientation Tape	NBL OCC
Class III Physical	Air Force Flight Physical CIII	NASA Flight Medicine
Duty Station Training	Dependent upon station	NBL OCC
Material Handling Equipment Operator	Material Handling and Lifting handbook certification	NBL OCC
Shop Equipment Safety	Shop Equipment Safety Training	NBL OCC
Authorization to Dive	Memo	EVA Project Office
Security Paperwork	Varies depending on country and purpose of visit. Plan <i>well</i> in advance of need.	NASA Security

Some requirements have expiration dates or required refresher training. Since policy varies, contact the NBL OCC for current requirements to ensure that you are informed of the latest requirements.

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7 **EQUIPMENT REQUIREMENTS**

To ensure the safety and uninterrupted operation of the facility, the following requirements must be enforced on all equipment brought into the facility. If you have any questions, please contact the NBL OCC.

Equipment	Restriction/Requirement
Electronic Equipment	Must be scanned for EMI/RFI by NBL technicians prior to operation.
Electronic/Electrical Equipment	<ul style="list-style-type: none"> • Must be properly grounded and electrically isolated. • Must remain a minimum of four feet (4') from the pool or they must be tethered to the user at all times while in use.
Rigging Equipment	Must have valid and current weight handling certification documentation.
Mockups	<ul style="list-style-type: none"> • Hazard Analysis Completed • Rigging Diagrams Completed • Material Certification Documentation • Test Readiness Review (TRR)
Mockups	Fabrication requirements NBL Trainer Guidelines DX12-0006
Forklifts, personnel lifts, etc.	Must be in safe working condition. All maintenance and inspections within periodicity.

7.1 **HARDWARE DELIVERY/STORAGE/REMOVAL**

New or modified hardware and equipment (mockups and tools) to be used during a test should be delivered assembled to the SCTF NBL or LMF not less than five working days prior to the test date. The five working days will allow for hardware buoyancy adjustments, testing, and TRRs prior to setup in the NBL.

Any deliveries requiring the use of handling equipment (e.g., crane, forklift) must be coordinated with the NBL OCC before and after the operation.

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Approved handling and lifting configuration instructions must be provided with the hardware. The appropriate NASA transportation Forms 290 of DD1149 must be completed.

The Test Sponsor (TS) is responsible for contacting the NBL OCC to coordinate the delivery of the mockup to the NBL or LMF. Once scheduled, the TS must arrange for the mockup to be transported to the designated site.

NBL personnel will assist in the assembly and installation of the mockup and hardware once received at the NBL. Initial assembly is the responsibility of the TS and their personnel.

To remove hardware permanently assigned to the NBL, contact the Property Custodian. A NASA Property Pass Request and Removal Permit, NASA Form 892, must be completed and approved.

7.2 CUSTOMER SUPPLIED PRODUCT (CSP) HANDLING PROCEDURE

This section explains the procedures for receiving, inspection, handling, movement, and subsequent shipment/release of customer-supplied products/equipment after training is completed.

Occasionally, customers supply mockups, outfitting or equipment that is to be used in various training exercises. This customer owned inventory is shipped or hand-carried to the NBL. All material must be received/checked in with the NBL Shipping and Receiving Department.

Although the NBL has temporary storage capability for material, the NBL is not responsible for hardware, mockups, tools or material stored in the building or laydown areas unless prior arrangements were made with the NBL. Special security requirements must be addressed in advance with the FM.

The Customer shall be responsible for the Customer Supplied Product. This responsibility shall include the security, integrity, inspection, and conformance to specifications, shipping, handling, installation, and removal of equipment utilized within the NBL. The Customer shall ensure that the use of CSP is appropriate for the intended application.

NBL personnel, if available, can be scheduled to assist a Customer on an as-needed basis. While the NBL will take every precaution to safeguard the CSP while at the facility, the EVA, Robotics, & Crew Systems Division assumes no responsibility for damages resulting from use or misuse while at the NBL.

The Property Custodian (PC) will assure all requirements regarding CSP used at the NBL will be adhered to. This includes obtaining a completed and signed CSP Customer Agreement Form, DX12-NBLF-003, identifying the hardware, maintaining a CSP Status Log, notifying the customer of any CSP loss or damage, and maintaining the Customer Agreement Forms as Quality Records.

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7.2.1 CSP Process

NBL Operations (Facility or Operations Manager) is notified that customer owned hardware is going to be used at the facility.

Customer will obtain a Customer Agreement (CA) Form and complete the customer portion of the form as required based upon the material to be used. The form must arrive with the hardware.

A TRR is scheduled.

Hardware arrives with the CA Form.

The CA Form is then give to the PC.

PC tags or identifies the items with JSC 911 tags.

PC reviews and completes the bottom portion of the CA Form including location, shipper, and FUR numbers (if applicable).

At the TRR, a copy of the CA Form is provided.

NOTE: If a CA Form has not been provided prior to the TRR, a form **MUST** be completed and signed at the TRR.

Customer is responsible for repackaging their equipment, including Quality Assurance regarding the packaging, and making arrangements for equipment shipment.

When CSP is returned to Customer, the Status Log is updated to reflect file closure and the CA Form is removed from the active file and maintained by the PC as a Quality Record.

NOTE: PC is responsible for notifying the customer of any CSP loss or unsuitability for use.

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8 PRE-TRAINING REQUIREMENTS

Prior to performing a test or training run in the pool, a series of events must occur to ensure the safety and proper configuration of the equipment to meet test objectives. The following guide outlines plans for a successful training event:

Action	Responsibility for Action		
	NASA	User	NBL
FUR Approval.	X	X	
Meet with Mockup Integration Engineering Team (IET) to determine training configuration needs. See Section 9.1, <i>IET External Users Requirement</i> .		X	
Prepare Customer delivered Mockups.		X	
Configuration and NBL Mockups support equipment.			X
Schedule Test Readiness Review (TRR).		X	
Schedule 1-g familiarization with divers and training subjects.		X	
Configure mockups in pool for test.			X
Conduct engineering run in pool to verify configuration and function.		X	X
Conduct test.		X	X

8.1 IET EXTERNAL USERS REQUIREMENT

The following requirements will assist Integration Engineering Team (IET) by providing information needed from the customer. This information will be evaluated to determine the capabilities and most efficient utilization of the Neutral Buoyancy Laboratory (NBL) concerning the requested pool layout and integration of customer hardware/mockups.

8.1.1 Pool Configuration Requirements

Requested NBL Mockups and/or orientation expected in the pool.

General mockup assembly configuration in the pool [this information must be delivered early (at least 4 weeks before run) to evaluate the capabilities and/or availability of NBL mockups requested and pool floor space.] Longer lead times may be required for major builds.

If any interface hardware is required between NBL support stands and external hardware/mockup, it is the external user's responsibility to fabricate and match existing NBL support stands interface and load restrictions.

Verify that this is the correct version before use.

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8.1.2 Shuttle Remote Manipulator System (SRMS) Requirements

The requirement for the following information is requested for the sole purpose of analyzing the capabilities of the NBL SRMS to support the requested SRMS operation.

Flight and/or “Pool Specific” Joint Angles with respect to start position and end position if suited subject is planning to translate with something.

NOTE 1: Centerline height of MAA (Multi-Attitude Article) with orientation (port up, payload up, etc.) will need to be stated with the SRMS Joint Angles.

NOTE 2: “Pool Specific” refers to positioning the SRMS in a location that simulates the SSRMS. With the restraints of the SRMS platform (MAA), these joint angles will not be “flight” and thus will need to be determined considering the “pool specific” configuration.

Data on Translating Object.

For more detailed information on NBL’s approach for the development of Neutral Buoyancy Trainers, refer to *NBL Trainer Guidelines* (DX12-0006).

8.2 TEST READINESS REVIEW (TRRs)

TRRs are conducted to:

- Provide NBL integrative test perspective
- Ensure appropriate analysis/precautions have been met
- Ensure facility requirements have been met
- Ensure facility can support test objectives.

A TRR must be conducted BEFORE the mockup will be allowed into the Pool. This restriction applies to new mockups or after ANY modification is performed on a mockup.

8.2.1 TRR Board Members

NBL Facility Manager - Chairperson

Medical Doctor

Neutral Buoyancy Office Project Lead

Operations Representative

Test Director

Test Safety Officer

Test Sponsor/Conductor

SRMS Representative (as required for tests using the SRMS)

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8.2.2 Testing Requirements Overview

The Test Sponsor/Conductor with the NBL IET is responsible for providing the following items in support of the TRR:

Dive/Test Plan (Ops Procedure Change)

Hazard Analysis

Lifting Diagram

Lifting Checklist/Critical Lift Plan

SRMS Document Package

Schedule

The Facility Representative(s) are responsible for the providing the following items in support of the TRR:

Facility & Support System Readiness

Test Team Readiness Schedule

9 USER FEEDBACK

The NBL is interested in improving the support provided to you. We strongly desire to hear user suggestions as to how we can improve our support and the equipment that you require for effective work performance.

9.1 GENERAL COMMENTS

If you have comments regarding the operation or conduct of the facility, either positive or negative in nature, contact the NBL OCC Manager.

9.2 DISCREPANCY REPORTING

If you have identified a specific safety hazard, deficiency with the facility, systems equipment, mockups or documentation, please contact the NBL OCC.